

The Levels of Processing Model of Memory

The first major challenge to the multi-store model came from Craik and Lockhart (1972). Although they accepted that the multi-store model accommodated the research findings reasonably well, they argued that there was also evidence to directly contradict it. The concept of rehearsal was criticised for being too general and unnecessary. The distinction between maintenance and elaborative rehearsal allowed Craik and his colleagues to argue that the number of rehearsals *per se* was less important in determining the transfer of information than the type of rehearsal engaged in by participants, and the study conducted by Craik and Watkins (1973) is consistent with such a claim.

In that experiment, Craik and Watkins (1973) asked participants to remember only certain 'critical' words (those beginning with a particular letter) from lists presented either rapidly or slowly. The position of the critical words relative to the others determined the amount of time a particular word spent in STM and the number of potential rehearsals it could receive. The researchers found that retention over long periods was unrelated to either the amount of time a word had spent in STM or the number of explicit or implicit rehearsals. On the basis of this and other findings (e.g. the serial position experiments), Craik and Watkins argued that in addition to maintenance rehearsal, in which material is rehearsed in 'rote' fashion, that is, the form in which it was presented, another type of rehearsal exists. They called this elaborative rehearsal (or elaboration of encoding), describing it as a form of rehearsal in which the material is elaborated in some way (such as by giving it a meaning or linking it with pre-existing knowledge). According to Craik and Lockhart (1972), it is the kind of rehearsal or processing that is important rather than the amount of rehearsal.

The multi-store model distinguishes between the structural components of memory (sensory memory, STM and LTM) and control processes (such as rehearsal and coding), with the latter being tied to the former. So, the multi-store model places its emphasis on the sequence of stages that information goes through as it passes from one structural component to another when being processed. Craik and Lockhart, however, began with the hypothesised processes and then formulated a memory system (the structural components) in terms of these operations.

According to Craik and Lockhart, memory is a byproduct of perceptual analysis. Crucial to their model is the concept of a central processor, capable of analysing data on a variety of levels. The processor is seen as being of finite capacity and therefore incapable of dealing with all aspects of a stimulus. The extent to which analysis can be controlled is determined by which features of the stimulus are paid attention to. The surface features of a stimulus (such as whether a word is in lower case or upper case letters) are analysed superficially or, to use Craik and Lockhart's phrase, processed at a shallow level. The semantic features of a stimulus (such as a word's meaning) are analysed more extensively, that is, they are processed at a deep level. Lying between these two ends of a processing continuum, a verbal stimulus can also be analysed according to its sound. Such processing occurs at a phonemic (or phonetic) level.

Which level is used depends on both the nature of the stimulus and the time available for processing. The model proposes that the more deeply information is processed, the more likely it is to be retained. In one test of this proposal, Craik and Tulving (1975) used a tachistoscope to present participants with a list of words. After each word had been presented, participants were asked one of four questions to which they had to respond 'yes' or 'no'. The four questions were:

- 1 Is the word (e.g. TABLE/table) in capital letters?
- 2 Does the word (e.g. hate/chicken) rhyme with wait'?
- 3 Is the word (e.g. cheese/steel) a type of food?
- 4 Would the word (e.g. ball/rain) fit in the sentence 'He kicked theinto the tree'?

Question (1) corresponds to structural processing, (2) to phonetic processing, and (3) and (4) to semantic processing. Later on, participants were unexpectedly given a test in which the words they had seen appeared amongst words they had not seen. The participants' task was to identify which words had been presented earlier. The researchers found that there was significantly better recall of words that had been processed at the deepest (semantic) level. Additionally, recognition was superior when the answer to the question was 'yes' rather than 'no'.

Several researchers have also found that elaboration, that is, the amount of processing of a particular kind at a particular level is also important in determining whether material is stored or not. For example, Craik and Tulving (1975) asked participants to decide if a particular word would be appropriate in simple sentences such as 'She cooked the ...' or complex sentences such as 'The great bird swooped down and carried off the struggling ...'. When participants were later given a test of cued recall, in which the original sentences were again presented but without the particular words, recall was much better for the words compatible with the complex sentences. Since the same depth of processing (semantic) occurred with both types of sentence, some additional factor (namely elaboration) must also be involved.

Bransford and his colleagues (1979) have shown that the nature of the elaboration is more important than the amount of elaboration. In their study, minimally elaborated sentences such as 'A mosquito is like a doctor because they both draw blood' were better remembered than multiply elaborated similies like 'A mosquito is like a racoon because they both have hands, legs and jaws'. One possible reason for this is that material which is distinctive or unique in some way is more likely to be remembered. This is another way of conceptualising 'depth' - it may be that it is the non-distinctiveness of shallow encodings (as opposed to their shallowness *per se*) which leads to their poor retention (Eysenck and Keane, 1995).

Eysenck (1993) has argued that it is often difficult to choose between level of processing, elaboration and distinctiveness because they can occur together. We know that retention cannot be predicted solely on the basis of level of processing because more elaborate or distinctive semantic encodings are usually better remembered than non-elaborate or non-distinctive ones. Thus, Eysenck and Eysenck (1980) found that a shallow level of processing could result in remembering that was almost as good as a deep level of processing, as long as it was also distinctive. Quite possibly all three make separate contributions to remembering, but distinctiveness, which relates to the nature of processing and takes account of relationships between encodings, is likely to be more important than elaboration, which is only a measure of the amount of processing (Eysenck, 1986).

Evaluating the levels-of processing model

Craik and Lockhart advanced their model as a new way of interpreting existing data and to provide a conceptual framework for memory research. It is generally accepted that the model contains a grain of truth, and that perception, attention and memory are interdependent. Prior to 1972, very few studies had compared the effects on memory of different kinds of processing, because it was implicitly assumed that any particular stimulus would typically be processed in a very similar way by all participants on all occasions. For Parkin (1987), the model is to be applauded because it has led to general acceptance of the idea that processing strategies may provide at least the basis for an understanding of memory.

The model has not, however, escaped criticism. For many researchers, it is a rather simplistic model which is predominantly descriptive rather than explanatory (Eysenck and Keane, 1995). For example, the model fails to address the question of why deeper processing leads to better recall. Another problem concerns the difficulty of defining or measuring depth independently of a person's actual retention score. So, if 'depth' is defined as 'the number of words remembered', and 'the number of words remembered' is taken as a measure of 'depth', the model's logic has a circular quality to it. Although attempts have been made to provide an independent measure to depth, Baddeley (1990) notes that there is no generally accepted way of independently assessing depth and that this 'places major limits on the power of the levels-of-processing approach'.

Finally, the model has been directly contradicted by some studies. For example, Morris (1977) has shown that rhyming recognition tests produce better recall when they are processed at the 'shallow' than the 'deep' level. It seems that the relevance of the processing is influential. If material is ordinarily processed at a shallow level, recall is better at that level. According to Parkin (1993), the different instructions participants are given vary in terms of the extent to which they require them to treat the stimulus as a word (compare, for example, 'Is a "tiger" a mammal?' with 'Does "tiger" have two syllables?'), yet retention tests always require participants to remember words. Since semantic tasks, by definition, require attention to be paid to stimuli as words, the superior retention they produce could reflect the bias of the retention test towards the type of information being encoded.